

paulins on No. 2, 5, 6, and 7 hatches burst open and in some cases blew away, thus allowing the sea water to find itself into the ship. \* \* \* we were on our course for Los Angeles at 9:25 a. m.

The barometer from which the reading of 27.40 inches was taken was carefully tested for temperature and pressure by the Weather Bureau office at San Francisco late in January 1940, and the result indicated that the minimum reading of 27.40 was .05 too low. In accepting 27.45 inches (929.6 millibars) as the correct figure, it remains outstanding as the lowest barometer reading on record in connection with a tropical cyclone occurring in southeastern North Pacific tropical waters.

NOTE.—A report received from the master of the *Nevadan* since the preparation of the foregoing text gives 20° N., 106°21' W., as the approximate position of the ship at time of lowest barometer.

#### THE APPROACH OF A GULF OF MEXICO NORTHER JANUARY 19, 1940

By WILLIS E. HURD

During the 19th of January 1940, a strong anticyclone, central over Texas, descended rapidly over the Gulf of Mexico, accompanied by subfreezing temperatures along the Texas coast and strong norther winds over the western and central Gulf.

At local noon of the 19th the American steamer *Antinous*, Colon toward New Orleans, was in latitude 21°44' N., longitude 86°14' W., with a northwest wind of force 1, barometer 1,015.9 millibars (30 inches), air temperature 82°, sea temperature 80°, weather fine and clear with a few scattered cumulus clouds, and smooth sea. D. Bolhuis, Second Officer on ship—Capt. C. Reed, Master—sent the Weather Bureau an interesting special report on the meteorological conditions attending the burst of the norther over the southeastern Gulf during the afternoon of the 19th and of its continuance during the forenoon of the 20th. Said Mr. Bolhuis:

At 3 p. m. (C. S. T.) dark clouds were observed on the northern horizon to east and west. By 3:15 p. m. they were advancing rapidly and heavy rain was observed. At 3:25 p. m. the norther struck the vessel, with wind from the northwest, force 5, and very heavy rain squalls; barometer steady at 29.97 inches (1,014.9 millibars); temperature of air 76° and sea at injection, 80°. Vessel steering from noon toward the north-northwest (true) at 13 knots. Heavy rains and steady northwest wind, force 5, continued until 8 p. m., then veering to north-northwest to north, force 6. Overcast with heavy rains, and short, choppy, rough sea and swell. At midnight the sky was overcast, with barometer rising steadily and reading 30.12; temperature of air 66° and of sea at injection 78°.

January 20, midnight till noon: Wind north, force 6, decreasing to force 5 at noon. Very little rain and barometer rising steadily to 30.2 inches (1,022.7 millibars). Noon position by dead reckoning, latitude 25°49' N., longitude 87°50' W.; temperature of air 55° and of sea at injection, 78°.

The sea seemed to be at its choppiest and roughest in latitude 23°21' N., longitude 87°03' W., near the 100-fathom curve off the northern coast of Yucatan.

#### LATE REPORT

#### TYPHOONS AND DEPRESSIONS OVER THE FAR EAST, DECEMBER 1939

BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

*Typhoon. November 29–December 5, 1939.*—This typhoon first appeared about 150 miles south of Yap, apparently well developed, indicating that it most likely formed far to the east of that locality some time previously. From its position south of Yap it moved along a west-

northwesterly course, gradually inclining to the northwest. It crossed Samar passing over the southern and central portions on December 2. It continued along this northwesterly course, the center fortunately moving over the water instead of over the islands, for example avoiding Masbate Island and Sorsogon Province. The center moved along the length of Ragay Gulf and crossed Camarines Norte as it inclined to the north, all the time decreasing in intensity and moving slowly. After December 5 it recurved to the northeast as a weak disturbance which soon disappeared over the ocean east of Luzon.

The newspapers of December 9 reported that the total loss of life due to this typhoon, according to reports received, was 34, all from Masbate Island where the rivers rose suddenly because of the heavy rains. There was great property damage along the course of the center, all due to floods and wind.

The barometric minima received from the stations of Samar, Masbate, and southern Luzon show that the storm was weakening as it progressed over the Archipelago. Borongan, Samar, had 730.50 millimeters (974.9 millibars) as its lowest pressure at 2 p. m. December 2, with southeast winds of force 4. Guiuan, Samar, reported 737.94 millimeters (983.8 millibars) with south winds force 9 at 11 a. m. of the same day. Late in the afternoon of December 2, the center passed between Catbalogan and Calbayog, Samar Island. The minima experienced at these stations were 732.91 millimeters (977.1 millibars) for Catbalogan and 731.64 millimeters (975.4 millibars) for Calbayog. Masbate had 731.65 millimeters (975.5 millibars) as its minimum, with winds from the northwest, force 1, during the morning hours of December 3. At Atimonan, Tayabas Pr., 744.03 millimeters (991.9 millibars) was reported as the minimum, with winds of force 7 from the north-northeast, December 4, at 4 a. m. At almost all of these stations, winds of force 10 to 12 were reported as the storm moved past the locality.

On the days preceding November 29, the upper winds over Guam showed the presence of a rather strong east quadrant current, backing from east-southeast to east-northeast, and with velocities as high as 50 kilometers per hour (Nov. 27). Most of these ascents were short and they do not give a very complete picture of the activity aloft. But after November 28 a strong east-southeast and southeast current set in, with velocities as high as 80 kilometers per hour. The Netherlands East Indies stations showed the presence of an extensive southwesterly and westerly current of air flowing toward the typhoon center. Menado was an excellent station for showing that the typhoon was intense. Although the reports were not received every day, yet there were enough to show the presence of a western and southwest quadrant current (depending upon the altitude) over the station, with velocities of 50 kilometers per hour and over at many levels. During these days, as the center approached the Philippines, Zamboanga did not have any definite southwesterly current until after December 1, when the pilots first indicated the approach of air from equatorial regions. After December 2, both Zamboanga and Cebu were in the southwest sector of the storm, with only a few short ascents being made. Manila and the stations of northern Luzon, however had north quadrant winds, strong and persistent. There were some ascents that showed velocities to be 100 kilometers per hour and over, while the usual values reported were between 50 and 80 kilometers per hour. There

was a tendency to shift to the north-northwest or north-west and this combined with the surface winds reported from stations in the Visayan Islands, gives the impression that this current of air from the north was deflected and became part of the southwesterly circulation of the storm, which may have been a factor in the weakening of the typhoon. Over Hong Kong, above the 2,000-meter level, there was a steady westerly current. In the opinion of the writer, this high westerly current was advancing southward during these days. But it was impossible to detect this from the pilot balloon ascents during the period; in fact, it was practically impossible to follow a balloon long enough to determine the presence of such a current, because of the rain and the clouds. But over Indochina on December 5, Saigon pilots showed the presence of west-northwest winds, 5 to 40 kilometers per hour, above 2,000 meters, which is the only ascent that can be used to confirm the opinion that the high westerly current was moving southward. If such really happened over the Philippines, then it is another factor in explaining the recurvature and the weakening of the typhoon.

*Typhoon, December 5-11, 1939.*—As a depression, intensity unknown, this disturbance formed about 200 miles southwest of Guam, moved west-northwest about 1,000 miles, and then recurved to the northeast, December 9th, over the ocean regions about 600 miles east-northeast of San Bernardino Strait. During recurvature, it manifested itself as a typhoon, retaining this intensity until December 11th, after which the available data indicate that it weakened to a depression or even a low pressure area.

The *M. S. Tai Ping* and the *Besholt* experienced the strength of the storm as they were proceeding to Manila via San Bernardino Strait. On December 10th, 3 to 5 p. m., ship's time, the *Tai Ping* passed through the calm area, which lasted about an hour, the minimum pressure being 714.4 millimeters (952.4 millibars), in latitude  $18^{\circ}12' N.$ , longitude  $135^{\circ}12' E.$  The same day, the *M. S. Besholt* had her lowest pressure, 740.9 millimeters (987.8 millibars) at 11 a. m. ship's time, near latitude  $18^{\circ}19' N.$ , longitude  $134^{\circ}00' E.$ , with north winds of force 12, which backed to north-northwest soon after the pressure began to rise.

The pilot-balloon observations reported from Guam during this period showed the existence of a northeast quadrant current, December 4, which changed to a powerful southeast quadrant current (velocities between 50 and 90 kilometers per hour) December 5th and 6th, which weakened on the following days. Over the Philippines, Cebu and Zamboanga had west and southwest quadrant winds, December 5 to 8, with velocities scarcely ever reaching 50 kilometers per hour. The northeast and north quadrant winds, which had been prevailing over northern Luzon, replaced the southwest and west winds as the typhoon recurved. Menado, Celebes Island, however, had southwest, west, or northwest quadrant winds, velocities under 60 kilometers per hour during the whole period.

*Typhoon, December 16-25, 1939.*—On December 15 there was a low-pressure area east of Mindanao, which intensified into a typhoon, December 16, central about 350 miles east of Surigao. From this position it moved rapidly

along a northwesterly course to the regions close to and northeast of San Bernardino Strait, where it changed to the west, thus passing over Albay, Sorsogon, and Camarines Sur Provinces. It continued moving westerly and crossed Bondoc Peninsula and then inclined to the northwest, preliminary to recurvature. The center then moved northerly close to and along the coast, passing east of Manila and entered the Pacific between Infanta and Baler. Over the ocean, it continued along a northeasterly course, moving very slowly December 20 to 22, when about 250 miles east of northern Luzon, and then very rapidly toward the Bonins. The center passed about 100 miles northwest of these islands early on December 24 and crossed the 150th meridian on its way toward the Aleutian Islands.

It is to be noted that this typhoon, when approaching the Archipelago, December 16 and 17, moved about 30 miles per hour, or faster than any other storm except one in 1908. Also on December 20 to 22, when the center appeared to be stationary East of northern Luzon, it is possible that it was moving in a loop, but more observations from the ocean regions are needed to be certain of this.

The station at Sorsogon reported 748.7 millimeters (998.2 millibars) as its minimum, which was the lowest value received. The winds were strong, in general force 6 and 7, with one or two stations reporting force 8, and there was heavy rainfall, especially along the Cagayan River valley and the province of Nueva Ecija of central Luzon. The total number of deaths, reported in the newspapers of December 23, was 33, most of which (19) were in Masbate, and the rest in northern Luzon.

The few days before December 16 showed the existence of a rather strong east and east-southeast current over Guam, the velocities varying from 20 to 70 kilometers per hour weakening after December 16. The reports from the Netherlands East Indies showed a distribution similar to that in the beginning of the month (Typhoon November 29 to December 5), but the velocities were much weaker, especially at Menado. As the center approached the Archipelago, Zamboanga and Cebu did not come under the influence of the southwesterly winds until December 17, the velocities at these two stations never reaching 50 kilometers per hour while the typhoon was in existence. Manila had west quadrant winds at isolated levels until December 24, after which the directions were from the north, northeast, or east quadrants. Cebu and Zamboanga did not have southwest or west quadrant winds after December 20.

*Typhoon, December 22-26, 1939.*—This typhoon probably formed over the Eastern Caroline Islands and moved westerly, first affecting the pressure at Guam on December 22. On the afternoon of that day it was about 200 or 250 miles south of Guam and it moved northwesterly during the night, causing heavy rains and gusty winds over Guam on the morning of December 23. It passed about 150 miles southwest and west of the island and inclined to the north and north-northeast on December 24 and 25 over the regions about 300 miles west of the Mariana group. The afternoon map, December 25, showed the typhoon moving east-northeast or northeast, apparently weakening as it approached the 150th meridian.

At Guam, on the morning of December 23, pressure fell to 748.2 millimeters (997.6 millibars) as the center approached and passed the island to the west; winds were from the east, veering to the southeast, force 9, decreasing to 8 during the forenoon. The S. S. *Washingtonian* came under the influence of the typhoon as it was recurving. The minimum pressure recorded on this ship was 746.5 millimeters (995.3 millibars), in latitude 18°00' N., longitude 143°48' E., December 24, 3 p. m., ship's time. The winds were from the south-southeast, force 9. The M. S. *Doña Aurora* also experienced the typhoon winds as it was recurving, but not as much as the *Washingtonian*, for southwest-by-south winds, force 3, were experienced in latitude 22°47' N., longitude 144°38' E., with a minimum

pressure of 756.8 millimeters (1,009.0 millibars), at 3 p. m., December 24 (ship's time).

The upper winds over Guam, December 20 to 22, were east-northeast, backing to northeast and north-northeast, with velocities from 20 to 67 kilometers per hour. There was no chance for any ascents on December 23, but the pilots of the 24th and 25th showed a south quadrant current, with velocities as high as 70 kilometers per hour and weakening. During the period of this typhoon, the pilots from the Netherland East Indies showed the existence of a persistent southwest and west quadrant current, the stations at Koepang and Menado indicating this very well, and it may be supposed that this air flowed toward and reached the typhoon center.

## CLIMATOLOGICAL TABLES

[Climate and Crop Weather Division, J. B. KINCEP, in charge]

### DESCRIPTION OF TABLES

By R. J. MARTIN

The description of tables and charts which appears in each January issue of the REVIEW has been separated this year into two parts with the chart descriptions immediately following table 4.

Table 1 presents average and extreme values for the 42 climatic sections into which the continental United States is divided, and for the sections of Alaska, Hawaii, and Puerto Rico, and is based on all available data collected by regular and cooperative Weather Bureau stations.

Table 2 gives the data ordinarily needed for climatological studies for about 180 Weather Bureau stations making simultaneous observations at 7:30 a. m. and 7:30 p. m. daily, 75th meridian time, and for about 20 others making only one observation. The altitudes of the instruments above ground are also given.

Beginning with January 1, 1932, all wind movements

and velocities published herein are corrected to true values by applying to the anemometer readings, corrections determined by actual tests in wind tunnels and elsewhere.

Table 3 gives, for about 37 stations of the Canadian Meteorological Service, the means of pressure and temperature, total precipitation, depth of snowfall, and the respective departures from normal values, except in the case of snowfall. The sea-level pressures have been computed according to the method described by Prof. F. H. Bigelow in the REVIEW of January 1902, 30: 13-16.

Table 4 lists the severe local storms reported in the United States during the month. It is compiled from reports furnished mostly by officials of the Weather Bureau. The portions of this table which describe tornadoes and windstorms other than tornadoes are summarized in the December issue of the REVIEW and more complete descriptions of tornadoes, other windstorms, and hailstorms are contained in the United States Meteorological Yearbook.